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LABOR SAVING ON SOUTHWESTERN COTTON FARMS\*

A Study in Motion and Time Saving

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Throughout the Southwest, from El Paso and Hudspeth Counties in the southwestern-most corner of Texas through New Mexico and Arizona to the San Joaquin Valley in California, high grades of cotton are grown on irrigated land. Virtually all of the American-Egyptian cotton grown in this country comes from this area and the other main type of cotton grown here -- Acala -- is also of superior grade and staple length.

The American-Egyptian or SxP cotton is of primary importance to the war effort. Acala cotton of good quality with staple length better than an inch and one-eighth is of at least secondary importance.

The growing labor shortage which has impeded the production of SxP and Acala cotton in the Southwest is therefore an important war problem. The main cotton-producing areas in the four States, California, Arizona, New Mexico and Texas, are confined to ten or twelve principal counties. These counties, with only a limited resident farm labor force, have a total labor demand at the peak of cotton harvest of at least 100,000.

These areas were immediately and sharply affected by the dwindling of the stream of migratory labor through the Southwest which took place during the past year. Within these areas also is a high concentration of other war industry in proportion to the total population. The rapid expansion of aircraft and shipbuilding on the coast of California is well known and there are many air bases under construction and various types of ordnance plants throughout Arizona, New Mexico and Texas. Among the groups which have provided much cotton-picking labor in the past, such as the Spanish-Americans, the effects of the draft have been severe. For example, it is estimated that in New Mexico alone the draft has been taking approximately 4,000 men a month, a large proportion of them Spanish-Americans with farm labor background.

APPROACHES TO THE LABOR SHORTAGE PROBLEM

Thus far the main approach toward solving the farm labor shortage problem in the Southwest as in other areas has been to try to find new sources of labor. The Southwest for many years, up to the beginning of intensive war preparations, had an over-abundance of labor. Labor-conserving practices in production were totally unnecessary; they were, therefore, not even thought of. It is only natural in a situation with this background that the immediate reaction would be to seek by some means to restore the past abundance of labor.

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Much can be accomplished with this approach and has been already through the Farm Labor Transportation Program of the Farm Security Administration. But it is becoming increasingly clear that as labor reserves dwindle in all areas, a positive effort must be made to solve the labor shortage problem with an opposite approach, that is by attempting to cut the amount of labor needed for a given amount of crop produced.

#### LABOR SAVING STEPS

It was with a view to finding means of reducing labor needed in cotton production that several weeks of experimental work were undertaken by the present writer during November and December 1942 in the Mesilla Valley in New Mexico. The work centered on labor saving in cotton picking, since this is the single operation that requires by far the greatest amount of labor at any one time.

Labor saving in nonagricultural industries has a long history. In the broadest sense, it is the history of the development of manufacturing through division of labor, the growth of the factory system and the introduction of steam and electric power. In this sense agriculture, too, has gone through a long process of labor saving. However, in the last 60 years, beginning with the pioneer work of Frederick W. Taylor and the Gilbreths, techniques have been developed which increase productivity by concentrating on improvement of the operations of the individual worker and the lay-out of a job without introducing radical changes in the type of machinery used or the general level of technological development. These techniques are called variously work simplification, scientific management, motion and time analysis. Under any name, this approach is valuable at all times as a means of increasing output. It becomes increasingly important in time of war when there is the greatest demand for more productivity, and the least possibility of obtaining new machinery. But, while it has led to astonishing results in factories, it has hardly been tried at all on farms.

Many reasons can be given for the failure of the techniques of work simplification to spread to agriculture; but this does not mean that the techniques do not apply. On the one hand the fact that the bulk of farming is split up among millions of relatively small units meant that from the point of view of the industrial engineer agriculture would not be a profitable field to explore. On the other hand, the fact that excess labor was usually available kept even the most scientific farmers from seeking motion economies on their own.

Actually there is every reason to believe that material savings in work can be made throughout agriculture. In the abstract, it may be argued that agriculture is a very old industry; that in very old industries there are usually deeply rooted work habits which are by no means the best methods; that there remains a great deal of hand operation in agriculture and that hand operations generally yield particularly readily to the work simplification approach. In concrete terms, it may be said that the present report demonstrates the labor savings which can be realized in one important section of farming.

The experimental work done in New Mexico centered around cotton picking itself, but it quickly became apparent that work must also be done on other aspects of the cycle of cotton production. Actually it was found that work could be done in five main directions:

1. On the function of the individual cotton picker.
2. On the work of an entire crew of cotton pickers.
3. Throughout the entire process of cotton raising.
4. On experiments with more radical changes in methods of cotton harvest which involve major problems of ginning.
5. On the general problem of labor relations on the cotton farm.

#### 1. WORK WITH THE INDIVIDUAL COTTON PICKER.

This work was preceded by considerable detailed observation of cotton pickers at work and by some cotton picking on the part of the writer. On the basis of these observations a tentative improved method of picking cotton was developed and tried experimentally with cotton pickers on four farms. For a variety of reasons difficulties in transportation, vagaries of weather, shifting conditions of the cotton itself and the high degree of turn-over among crews -- it was impossible to carry on this work with more than a few workers on these four farms; nevertheless, results were immediately forthcoming and quite clear cut. There were immediate increases in productivity following only a brief period of instruction, ranging from 20 to 40 percent and averaging between 30 and 35 percent.

It was found that the effects of the instruction, if not repeated or backed up with continuous supervision, started to dwindle away in the course of a week or 10 days. There was also the danger, without continued supervision, of the improved method of cotton picking resulting only in sloppier work with some increase in speed. In general, the proposed improved method led to some 2 percent increased loss in cotton left behind -- a relatively small percentage considering the saving of labor time, but there was reason to believe that even this waste could have been eliminated with further practice if time had permitted. In this, as in all other respects, it must be stressed that the few weeks' work done was merely a preliminary breaking of ground in a new field.

The actual steps taken to improve the work of the individual cotton picker include the following:

A. Equal use of right and left hands. Most cotton pickers claimed that they were using both hands equally, but close observation revealed that one hand, usually the right, of course, generally leads in picking in the ratio of 3 to 2 or 2 to 1. Although this is common knowledge, it should be mentioned that the cotton is extracted from the burr by a simple picking

motion of the fingers, one boll at a time for each hand. As in most other similar hand operations, it is entirely possible for both hands to be equally occupied. Equal use of each hand in a steady rhythm led to immediate gains in output.

B. Orderly movement of the hands over a cotton plant. The picker usually moves slowly forward between two rows of plants, towing the long sack which is either tied around the waist or slung over the shoulder. The cotton is picked from the row on each side alternately and the picker moves forward as necessary to reach new plants.

It was found that there was a tendency for some of the cotton pickers to work in a varying, irregular pattern with the hands moving backward and forward and backward again along a row, and up and down and up again on one plant. The tendency was augmented by the fact that the cotton sometimes grows irregularly, some plants having a scanty yield and some having stalks that grow wildly even over into an adjoining row.

Arm and body movement was reduced, and time therefore saved, by working steadily and systematically on one plant at a time, with the hands relatively close together, following an orderly pattern on each plant, generally starting at the outside lower part of the plant and working around and over it.

C. Palming cotton. It was found that most fairly good pickers would palm some cotton; that is, retain cotton in their hands after picking it and before putting it in their sacks and while picking from other bolls. There was variation in this practice, too, and some pickers (and most pickers occasionally) put the cotton from one boll at a time in the sack. It was found that there was an advantage in palming greater amounts and only putting the cotton in the sack when the hands had worked around to a position close to the mouth of the sack. The exact number of bolls to be picked before cotton should be put in the sack could not even be approximated because of variations in yield and in the sizes of pickers' hands.

D. One pick to each boll. It was found that much time was lost in making several stabs at any one boll in order to extract all the cotton from it. Immediate improvement was registered by attempting in so far as possible to extract all the cotton in one sharp movement (just as typists are taught never to make strike-overs).

It is probably this step which was mainly responsible for the 2 percent increase in cotton left behind, referred to above. However, there were evidently several means of reducing the waste while making only one pick to a boll, although these could probably not be definitely established without use of micro-motion film. The fingers must grasp the cotton firmly, all the way around, close in to the burr. The cotton must be picked out sharply. It is also very probable that a slight twisting motion aids in extracting all the cotton in one pull. This last point relates not to improvement of the picking motion as such but rather to the anatomy of the plant. The cotton grows in several locks in any one burr. There is a tendency in picking, say five-lock cotton, for perhaps four locks to come out and a fifth to remain behind. The slight twisting motion tends to bind the locks together and so bring them all out at once.

The four steps detailed here do not necessarily make up the best method of picking cotton. Among the four steps it is difficult to say which is most important. Others probably can be found. In the present experiment, the mere fact of some sort of close supervision may account for much of the results. But one point of major importance was established: The cotton picker's output is variable; it can be increased; and it can be increased by relatively simple means.

As stated previously, the method described here was tried with individual workers on four farms, with gains in productivity for various trial periods of more than an hour each ranging from 20 to 40 percent. In no case did the experiment benefit from use of inexperienced workers who could be expected to increase their output in any case. All of the trial workers had picked much cotton over periods of at least several years in the past. Two of the pickers considered themselves past their best working years.

The method as described was worked out by observation and deduction. It was not based on imitation of the best workers, simply for the reason that for some time it was not possible to find a worker whose output could be considered unusual. However, when the experiment was well underway, a cotton picker was found whose regular output was at least twice the average for adults. He furnished perhaps the most dramatic demonstration of the usefulness of the methods. He himself went through each of the phases which had had to be worked out deductively; he used right and left hands almost exactly equally; he worked in a fast but orderly pattern over each plant; he palmed large amounts of cotton; he almost always got all the cotton from a boll in one pick.

Some mention should be made of other approaches which were tried with negative results because further work with them may also yield material savings of labor. For example, there was no immediate gain from confining picking to one row at a time as against the customary practice of moving between two rows and picking alternately on each side. However, this should get a further trial since it is reported from other parts of the country that some of the very best pickers have increased their speed by one-row picking; that is, they conserve arm motion at the cost of doubled but still slow bodily movement along the row.

Similarly, there unquestionably should be considerable experimentation with the proper shape and position of the cotton sack. It is almost certain that some gains would be made by carefully working out a proper relationship of work and rest periods.

## 2. WORK WITH AN ENTIRE CREW

It was impossible in the short time available to work on the organization of the activity of an entire crew of cotton pickers, particularly since in the early phases of the experiment this would have involved considerable risk of loss to the cotton grower. However, this is the phase of labor saving which probably needs the least experimental demonstration. The evidence of waste of labor and time in the operation of an entire crew is obvious to the naked eye and it was agreed by several growers that at

least a 15 percent saving of time of the entire crew could be made with relative ease. Wasteful practices include the carrying of empty sacks along rows some 750 feet in length before beginning work; carrying full sacks some 500 feet back along the rows to the place where they are weighed and dumped into the wagon; having the cotton weighed by the pickers themselves and dumped by them into the truck at a time when at the very least they could be thoroughly resting their backs. Time is lost even in the selection of rows in which to work. Eliminating this type of waste would involve delegating one person (possibly the weighman himself) to bring in full sacks for weighing, giving the picker an extra sack to use in the interim, and allowing pickers a genuine rest period at more rationally determined intervals.

### 3. LABOR SAVING POSSIBILITIES THROUGHOUT THE PROCESS OF CULTIVATION.

It quickly became clear that there were many aspects of the entire process of cotton growing that ought to be probed for labor saving possibilities even though experimental work was impossible in the short time available. For example, in the Mesilla Valley two main varieties of Acala cotton were commonly in production and the relative merits of these and many strains of each were subject to continuous debate. It would be well worth determining not only such qualities as staple length, yield and tensile strength, but also the ease with which the cotton leaves the burr and therefore may be picked.

There was also discussion as to the effects of more and less irrigation on the ease with which cotton picks. This would be worth considerable detailed investigation.

It was fairly well demonstrated that proper dusting of the growing plant to control insect pests also improved yield and picking qualities of the cotton.

Planting of the cotton itself in particular types of beds, as for example, the cantaloupe type bed seemed advantageous. Improved ease of irrigation and cultivation would probably make the cotton harvest itself somewhat easier.

A very important variable is the amount of seed planted to the acre. Experiments indicate that good stands could be obtained with the use of acid-treated and delinted seed, with far less than the usual 30 pounds of seed per acre. In fact, on one farm a planting of only  $3\frac{1}{2}$  pounds of good seed yielded in the neighborhood of two bales to the acre. It is quite obvious that the planting of smaller amounts of seed, apart from savings in the cost of seed itself, also eliminates considerable labor in the early part of the season during cotton chopping. This might even reduce harvesting labor needed since if a better job of cotton chopping and cultivation could be done with greater ease the fields might well be relatively more weed free and, therefore, easier to pick at harvest time.

### 4. COTTON SNAPPING VERSUS COTTON PICKING.

On the South Plains of Texas the cotton is pulled or snapped. That is to say, the picker snaps off the entire burr, leaving the lint in it and the burr is removed in the gin. In the irrigated country farther west,

cotton is harvested by the customary practice of picking the lint out of the burr on the plant in the field. Under most conditions cotton snapping or pulling can be done about twice as rapidly as ordinary cotton picking. The big difficulty here is at the gin. Ginners in the Mesilla Valley state that the excess burr can be removed only by excessive ginning with a resulting loss in the quality of the cotton. At the very least the problem of removing excess burr without loss of quality should be thoroughly plumbed by a competent technical committee. If any simple solution can be provided at the gin, productivity of most cotton pickers can be doubled immediately.

#### 5. THE GENERAL PROBLEM OF LABOR RELATIONS.

To introduce the improved methods suggested above involves a proper framework of labor relations on cotton farms. It has been stated already that the nature of the present situation is much affected by past surpluses of cotton-picking labor. This had the additional effect of making any type of supervision unnecessary from the grower's point of view. It is this background which must be overcome.

As part of the same problem and before ideas of labor saving and work simplification can be materially spread throughout the irrigated cotton areas, it will be necessary to overcome one idea frequently expressed: if their productivity and earnings increase, cotton pickers as a whole will simply work fewer hours, since it is claimed there is some absolute quantity above which they do not wish to earn. This idea can be refuted factually in terms of the experience of other industries and of other sections of agriculture this year. However, to eliminate its effects and implications would involve a working system of proper management labor relations on the farm.

Related to the entire problem of good labor relations as a labor saving means is the undoubted benefit in terms of output -- now agreed to by many growers -- of better housing and similar facilities for cotton pickers.

#### CONCLUSION

It is proposed that the labor saving approach be given full weight on the agenda of all farm labor bodies and committees considering the problem of wartime labor shortage. Enough has already been demonstrated to indicate that farm labor productivity is a highly variable thing and that it can be increased by relatively simple means if these only be found and be properly spread throughout the community. That the farm labor situation has already suffered much deterioration is painfully clear. One can pass many cotton fields with large crews at work and see no more than a handful of adult males of good working age at work. In the Mesilla Valley of New Mexico, for example, the cotton harvest was probably pretty well up to schedule but this was accomplished through the wasteful and inefficient use of great quantities of child labor for which purpose public schools were closed down.

As a final point it should be noted that the labor saving approach, through increase of output and therefore of earnings, will also help to solve the other major problem of retaining or acquiring more labor by making cotton-picking employment more attractive.

